State of California
AIR RESOURCES BOARD

ARB/SSD-97-XXX
DRAFT PROPOSED

DETERMINATION OF REASONABLY AVAILABLE CONTROL TECHNOLOGY AND BEST AVAILABLE RETROFIT CONTROL TECHNOLOGY FOR ADHESIVES AND SEALANTS

February 1997

Prepared by
Industrial Section
Criteria Pollutants Branch
Implementation Section
Air Quality Measures Branch
Stationary Source Division
P.O. Box 2815, Sacramento, California 95812

February 28, 1997

Dear Sir or Madam:

Enclosed for your review is the *"Draft Proposed Determination of Reasonably Available Control Technology (RACT) and Best Available Retrofit Control Technology (BARCT) for Adhesives and Sealants"* (RACT/BARCT determination). The determination proposes volatile organic compound limits for adhesives and sealants used in commercial and manufacturing processes.

The California Clean Air Act (CCAA) of 1988 requires, among other things, that local air quality management and air pollution control districts (districts) develop attainment plans to achieve the state ambient air quality standards as expeditiously as practical. These plans must include regulations that require control technologies for reducing emissions from existing sources. RACT/BARCT determinations are developed to aid districts in developing regulations to attain and maintain the state ambient air quality standards. The determinations also promote consistency of controls for similar emission sources among districts with the same air quality attainment designations.

The proposed limits in the RACT/BARCT determination are largely based on limits adopted in existing district adhesives and sealants rules. The RACT/BARCT limits were initially presented and discussed in workshops held on September 30 and October 5, 1993. Since that time, we have made modifications to some of the limits and added additional categories based on comments received in response to the draft proposal. If there is sufficient interest, we will hold an additional workshop later this year.

We are asking that you submit any comments on the enclosed draft RACT/BARCT determination by April 18, 1997. Comments may be directed to Ms. Sue Kaiser, Implementation Section, at the letterhead address, by telephone, or by fax at (916) 327-5621. If you would like to participate in a workshop to discuss the RACT/BARCT determination, please indicate your interest when you submit your comments, or call Ms. Kaiser at (916) 327-5628.

Sincerely,

Genevieve A. Shiroma, Chief
Air Quality Measures Branch

Enclosure

Sir or Madam

cc: California Air Pollution Control Officers Association's
Adhesives Committee

Ms. Sue Kaiser
Implementation Section
Air Quality Measures Branch

ACKNOWLEDGMENTS

This determination was prepared by the Air Resources Board staff in cooperation with the California Air Pollution Control Officers Association's Adhesives Committee and with the participation of industry representatives.

CAPCOA
Adhesives Committee

Stan Cowen, Chair	Ventura County APCD
Janette Brooks	Air Resources Board
Tad Bixler	Santa Barbara County APCD
Paul Chad	San Diego County APCD
Jack Ferguson	Sacramento Metropolitan AQMD
Anupom Ganjuli	South Coast AQMD
Bill Guy	Bay Area AQMD
Duane James	U.S. EPA Region IX

Principal Authors

Terrel Ferreira
Bob Nguyen
Eric White
Sue Kaiser (editor)

We would also like to thank: Al Baez, South Coast AQMD; Corie Choa, South Coast AQMD; Dave Hodges, U.S. EPA Region IX; Marty Kay, South Coast AQMD; Andrew Lee, South Coast AQMD; Maria Lima, San Joaquin Valley Unified APCD; Bill Milner, South Coast AQMD; Nicole Reaksecker, U.S. EPA Region IX; Anita Shuhevych, Bay Area AQMD; Laura Yannayon, San Diego APCD; and Gary Yee, Air Resources Board.

DEDICATION

This RACT/BARCT guidance document is dedicated to the memory of Monty Price, a founding member of the CAPCOA Adhesives Committee, who passed away in May 1994. Although Monty was not around to see the publication of this document, he was instrumental in its development. Monty worked tirelessly for the South Coast Air Quality Management District and authored many rules including Rule 1168, which was the basis for much of this document. All of us who worked with Monty have nothing but praise for his ability, his knowledge, his willingness to listen and communicate, his caring, and his great sense of humor. Monty touched our lives, and we are better for it. We will miss you, our dear friend and colleague.

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DRAFT PROPOSED RACT/BARCT DETERMINATION FOR ADHESIVES AND SEALANTS

I. INTRODUCTION

This report presents the determination of reasonably available control technology (RACT) and best available retrofit control technology (BARCT) for controlling volatile organic compound (VOC) emissions from the commercial and industrial application of solvent-based adhesives and sealants. The determination also applies to the manufacture and sale of adhesives and sealants. The determination was developed by the Air Resources Board (ARB) staff, in cooperation with the Adhesives Committee of the California Air Pollution Control Officers Association (CAPCOA). The RACT/BARCT determination is presented in Appendix A.

A. Background

The California Clean Air Act (CCAA) of 1988 requires, among other things, that local air quality management and air pollution control districts (districts) develop attainment plans to achieve the state ambient air quality standards as expeditiously as practical. These plans must include regulations that require control technologies for reducing emissions from existing sources. RACT/BARCT determinations are developed to aid districts in developing regulations to attain and maintain the state ambient air quality standards. The determinations also promote consistency of controls for similar emission sources among districts with the same air quality attainment designations.

While the CCAA does not define RACT, RACT for existing sources is generally considered to be those emission limits that would result in the application of demonstrated technology to reduce emissions (ARB, March 1990, p. 3). BARCT is defined in the California Health and Safety Code, section 40406, as "an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source."

In developing this RACT/BARCT determination, the Adhesives Committee evaluated district adhesive and sealant rules to ascertain ways in which the standards could be improved. The Adhesives Committee reviewed the adopted rules of the South Coast Air Quality Management District (AQMD) (Rule 1168), Bay Area AQMD (Rule 8-51), and Ventura County Air Pollution Control District (APCD) (Rule 74.20). These rules in aggregate represented the most current and effective standards to reduce VOC emissions from adhesives and sealants at the time the RACT/BARCT determination was initially developed. Since then, five other districts have adopted adhesives and sealants rules: El Dorado County APCD, Placer County APCD, Sacramento Metropolitan AQMD, San Joaquin Valley Unified APCD, and Yolo-Solano AQMD. A list of the districts with adopted adhesives and sealants rules, the rule numbers, and dates of adoption is presented in Appendix B.

Public workshops to discuss the RACT/BARCT VOC limits were held on September 30 and October 5, 1993. Appendix C contains a summary of comments received and staff's responses to those comments.

B. Overview of Adhesives and Sealants

Adhesives and sealants are used in product manufacturing, packaging, construction, and installation of metal, wood, rubber, plastic, ceramics, or fiberglass materials. An adhesive is any material used to bond two surfaces together. A sealant is a material with adhesive properties that is used primarily to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces. Often, adhesives and sealants share the same chemical type. For example, silicones are available both in adhesive and sealant formulations. There are hundreds of adhesives and sealants and thousands of different products.

Adhesives may be classified as structural and nonstructural. Structural adhesives, used in industrial assembly processes, maintain structural integrity of the product. Structural adhesives are synthetic adhesives that bond by a cross linking chemical reaction, rather than curing by solvent evaporation. The main types of structural adhesives are thermosetting adhesives and alloys of these with thermoplastic or elastomeric adhesives. Nonstructural adhesives, such as sealants and conductive adhesives, normally cannot withstand structural stress.

Sealants are used to prevent the passage of a liquid or gas between two surfaces, while being flexible and resistant to substrate movement. Generally, sealant products have low solvent levels, high concentrations of fillers, and are thick and nonpourable. High performance sealants are based on polymers of sulfides, silicones, and urethanes. Caulks, low performance sealants, are based on butyls, acrylics, and polyvinyl acetate polymers and are available in waterborne or solvent-borne formulations.

Many adhesive and sealant applications require the prior application of a primer. Primers are used to wet the surface of the substrate, improve the bondability of the adhesive or sealant to a poor substrate, and sometimes provide corrosion protection. Typically, primers are applied in very thin films. The most common type of primer is a one-part system in an organic solvent. Increasingly, thermosetting or two-part primers are being developed.

C. Adhesive and Sealant Emissions

Adhesive and sealant VOC emissions result from evaporation of solvents during transfer, drying, surface preparation, and cleanup operations. These solvents are the media used to solubilize the adhesive or sealant material so that it can be applied. The solvent is also used to completely wet the surface to provide a stronger bond. In plastic pipe bonding, the solvent dissolves the polyvinyl chloride pipe and reacts with the pipe to form a bond. Solvents used to clean the surface before bonding and to clean the application equipment after bonding also contribute to VOC emissions.

The ARB staff estimates that in 1994, adhesive and sealant VOC emissions were 45 tons

per day (t/d) statewide, 35 t/d of which are attributed to solvent-based products. The RACT/BARCT determination requires the use of low-VOC or low-vapor pressure materials or the use of equipment or procedures that will reduce VOC emissions.

Some adhesive products are formulated with exempt solvents which are not treated as VOCs. Among these exempt solvents are halogenated or partially halogenated carbon compounds such as methylene chloride and 1,1,1-trichloroethane. There is a potential for increased use of these solvents as the limits in this determination are implemented. However, because many of these compounds can cause toxic health effects or contribute to stratospheric ozone depletion or global warming, regulatory agencies are increasingly restricting their use. For example, the 1990 federal Clean Air Act amendments required that the production of 1,1,1-trichloroethane be terminated by 2002, a requirement that was accelerated to January 1996 by amendments to the Montreal Protocol adopted in November 1992. Also, in California, many districts have developed policies to regulate the use of compounds that are toxic or can contribute to stratospheric ozone depletion or to global warming. This determination does not address these impacts.

Finally, the standards in this determination were developed before the United States Environmental Protection Agency (U.S. EPA) and the ARB exempted acetone as a VOC. Districts adopting rules based on this RACT/BARCT determination will need to consider the new status of acetone and the impact of its exempt status on the VOC limits.

II. RACT and BARCT RECOMMENDATION

Staff recommends that the determination in Appendix A be defined as RACT/BARCT for adhesive and sealant emissions of VOCs. This determination is based largely on the South Coast, Bay Area and Ventura County adhesive and sealant rules and represents control technology that is available and cost-effective. Table 1 summarizes the requirements of the RACT/BARCT determination.

A. Overview of Requirements

The determination contains VOC limits for various adhesive and sealant categories (refer to Table 1 or Appendix A for applicable limits). The VOC limits are expressed in terms of grams of VOC per liter (g/l) of adhesive, less water and exempt compounds. For aerosol adhesives, the VOC limits are expressed as percent VOC by weight.

There are six categories of VOC limits: (1) adhesives, (2) sealants, (3) adhesive primers, (4) sealant primers, (5) adhesives application onto substrate, and (6) aerosol adhesives. Categories one through four provide VOC limits for specific applications of adhesives, sealants, and primers. These applications address the specific concerns of industry for appropriate and achievable VOC limits. The necessity for these specific limits arises from the limited availability of adhesives that can meet specific performance criteria.

If an application is not listed under one of these four categories, the VOC limits in the fifth category (adhesives application onto substrate) would apply. Category five differs from the other four in that specific operations are not listed. The VOC limits are based on the type of substrate. For applications where two different substrates are being bonded, the higher VOC limit of the two would apply, unless specified otherwise.

The last category is aerosol adhesives. A percentage standard is specified because it is difficult to verify the quantity of VOC in an aerosol medium in terms of mass of VOC per volume of adhesive. District staffs have found that a mass percent standard for aerosol products is enforceable.

Assembly Bill (AB) 1849 (Ch. 766, Stats. of 1996) amended the Health and Safety Code to require, effective January 1, 1997, that the ARB's 75 percent VOC standard for aerosol adhesives apply statewide to the consumer, commercial, and industrial uses of aerosol adhesives. On that date, district rules limiting the VOC content, or emissions from, aerosol adhesives are null and void. After January 1, 1997, a district may adopt and enforce the ARB's 75 percent standard, or a subsequently adopted standard. AB 1849 also requires, on or before July 1, 2000, that the ARB prepare a study and conduct a public hearing on the need for, and feasibility of, establishing a more stringent standard or standards for aerosol adhesives. If the ARB finds that more stringent limits are expected to become feasible, a more stringent standard shall be adopted, at a minimum constituting BARCT unless the ARB determines that those measures are not achievable. On or after January 1, 2000, a district may adopt and enforce a rule setting a standard that is more stringent than the ARB's.

The ARB is amending the consumer products regulation (Title 17, California Code of Regulations, sections 94507-94517) to include the commercial and industrial use of aerosol adhesives, thereby providing a mechanism for statewide ARB implementation and enforcement. However, some districts may prefer to adopt and enforce the ARB's aerosol adhesive standard. The aerosol adhesive VOC limit in the RACT/BARCT determination is consistent with the ARB's current 75 percent standard as well as the future 25 percent standard scheduled to take effect on January 1, 2002.

Table 1
Adhesives and Sealants Application Operations
RACT/BARCT Summary

Applicability

Any person who supplies, sells, offers for sale, or uses adhesives, sealants, adhesive primers, or sealant primers.

Requirements

A. Standards

	VOC LIMITS (g/l)	BARCT VOC LIMITS (Effective 1/1/98) (g/l)
(1) Adhesives:		
ABS welding	400	
Ceramic tile installation	150	130
Computer diskette manufacturing	850	
Contact adhesive	200	
Cove base installation	200	150
CPVC welding	490	
Indoor floor covering	150	
Metal to urethane/rubber molding or casting	850	250*
Multipurpose construction	200	
Nonmembrane roof installation/repair	300	
Other plastic cement welding	510	
Outdoor floor covering	250	
PVC welding	510	
Single-ply roof membrane installation/repair	650	250
Structural glazing	100	
Thin metal laminating	780	250*
Tire retread	100	
(2) Sealants:		
Architectural	250	
Marine deck	760	
Nonmembrane roof installation/repair	300	
Roadway	250	
Single-ply roof membrane installation/repair	450	
Other	420	
(3) Adhesive Primers:		
Automotive glass	700	
Plastic cement welding	650	
Single-ply roof membrane	650	250*
Traffic marking tape	550	150
Other	250	

* These standards are technology forcing (see page 9).

	VOC LIMITS	BARCT VOC LIMITS

	(g/l)	(Effective 1/1/98) (g/l)
(4) Sealant Primers:		
Architectural		
- Non porous	250	
- Porous	775	
Marine deck	760	
Other	750	
(5) Adhesives Application Onto Substrate:		
Flexible vinyl to flexible vinyl	660	250
Flexible vinyl to any other substrate	250	
Fiberglass	200	
Metal	30	
Plastic foam	120	
Porous material (except plastic foam)	150	120
Rubber	650	250
Other substrates	250	

If an adhesive is used to bond dissimilar substrates together, except for bonding flexible vinyl to any other substrate, the applicable substrate category with the highest VOC content shall be the limit for that operation.

B. Aerosol Adhesives

A person shall not use any aerosol adhesive unless the VOC content, including the propellant, does not exceed 75 percent by weight. Effective 1/1/2002, the VOC content of aerosol adhesives shall not exceed 25 percent by weight*.

C. Alternative Control Requirements

Add-on control systems with at least 85 percent overall control efficiency (capture and destruction efficiency), by weight.

D. Other Requirements

- Storage of VOC Containing Material
- Compliance Statement
- Prohibition of Specification

E. Optional Requirements (To be adopted at the discretion of the district)

- Cleanup Solvent
- Sales Prohibition

* These standards are technology forcing (see page 9).

Exemptions

- Tire repair adhesives
- Undersea-based weapon systems
- Research and development
- Solvent welding operations for medical devices
- Plaque laminating operations
- Products or processes subject to other district rules
- Low-VOC products (less than 20 g/l)
- Low usage (less than 55 gallons per calendar year)
- Small source (not more than 200 pounds VOC emissions from adhesive operations per calendar year)
- Adhesives subject to the consumer products regulation (optional; for districts not adopting sales prohibition)
- Reserved for specific exemptions determined by the Air Pollution Control Officer (APCO) to be technologically infeasible or not cost-effective to retrofit

Recordkeeping Requirements

- Monthly volume of each adhesive, sealant, primer and cleanup solvent used
- Material list (e.g., material name, manufacturer ID, application)
- Catalysts, reducers, or other components used and the mix ratio
- VOC or vapor pressure limit and actual content of material used
- Daily records for noncomplying material and key operating parameters when emission control equipment is used
- Maintain records for minimum of 2 years

Test Methods

- U.S. EPA Reference Test Method 24 or South Coast AQMD Method 304 for the determination of the VOC and solid content of all non-aerosol adhesives
- ASTM Test Method D4457-85 for the determination of exempt compounds
- ARB Method 310 for the determination of the VOC content of aerosol adhesives
- South Coast AQMD Method 316A for the determination of the VOC content of any plastic cement adhesives or primers
- Proposed South Coast AQMD Method ___ for the determination of the VOC content of cyanoacrylate adhesives
- ASTM Method E260-91, D3792-79, and D2879-86 for the determination of the composite vapor pressure of organic compounds in cleaning materials
- U.S. EPA protocols for the determination of capture efficiency or a district capture efficiency determination method approvable by the U.S. EPA
- U.S. EPA Reference Test Method 25, 25A, 25B, or ARB Method 100 for the determination of control efficiency
- South Coast AQMD's "General Test Method for Determining Solvent Losses from Spray Gun Cleaning Systems" for the determination of the active and passive solvent losses from spray gun cleaning systems

Several adhesive and sealant applications and products are exempt from this determination: tire repair, assembly and manufacturing of undersea-based weapon systems,

testing and evaluation associated with research and development, solvent welding operations for medical devices, plaque laminating operations, products or processes subject to other district rules, low-VOC products (less than 20 g/l), and adhesives subject to the ARB's consumer products regulation (optional; for districts not adopting the sales prohibition, as explained below in section D). Additionally, the determination provides an exemption for adhesive operations that use less than 55 gallons per calendar year of noncomplying adhesives, and for stationary sources that emit not more than 200 pounds of VOCs per year from adhesives operations. Any person claiming one of these latter two exemptions must maintain records that substantiate this claim.

The determination also includes an alternative compliance provision for using add-on control systems, such as carbon adsorption or incineration systems. If add-on control systems are used, they must achieve at least an 85 percent overall control efficiency (i.e., the product of the capture efficiency and the destruction efficiency must be at least 85 percent on a mass basis). The capture efficiency may be determined according to U.S. EPA protocols referenced at 55 FR 26865, the U.S. EPA Technical Document, Guidelines for Determining Capture Efficiency (January 9, 1995), or a district capture efficiency determination method approved by the U.S. EPA.

Monthly usage records are required for all adhesives, sealants, primers, and solvents at a facility. All pertinent information must be available to determine compliance with the determination. For add-on control equipment, daily records are to be maintained of key operating parameters for the emission control equipment, including but not limited to hours of operation and maintenance activities.

U.S. EPA Test Method 24 or South Coast AQMD Method 304 is specified for determining the VOC and solids content of non-aerosol adhesives. ARB Method 310 is required for determining the VOC content of aerosol adhesives. South Coast AQMD Method 316A is required for determining the VOC content of plastic cement adhesives or primers. Proposed South Coast AQMD Method ___ , when approved, will be required for cyanoacrylate adhesives.

B. RACT Limits

With very few exceptions, the RACT VOC limits in the determination are found in existing district rules and have been determined by district staff to be achievable and cost-effective. In most cases, the adhesive and sealant industry is currently complying with these limits (refer to Table 1 or Appendix A for applicable limits).

C. BARCT Limits

In addition to the RACT limits, the determination contains BARCT limits which may be optional according to a district's attainment status. Generally, BARCT limits are more stringent than RACT limits for the same source. As with the RACT limits, the VOC limits listed as BARCT are contained in district rules and in many cases, are already being implemented (refer to Table 1 or Appendix A for applicable limits).

Some BARCT limits are considered technology forcing: metal to urethane/rubber molding or casting, single-ply roof membrane primer, flexible vinyl to flexible vinyl adhesives aplication onto substrate, and aerosol adhesives. Technology forcing limits are limits that may not currently be met, but are based on anticipated technological developments that industry expects to be available in the near future. The Committee believes that adhesives technology will advance sufficiently to meet these limits by the future compliance date of January 1, 1998 (January 1, 2002 for aerosol adhesives).

Because the availability of products to meet the technology forcing limits is uncertain, the Committee suggests that districts consider the options discussed in the ARB-CAPCOA Suggested Control Measure for Architectural Coatings (ARB, 1989, pp. 28-29), to address potential State Implementation Plan (SIP) conflicts with the U.S. EPA. These options are:

1. The districts adopt technology-forcing standards now, and address the issues later in the event complying adhesives and sealants are not available by the effective date.

2. The districts not adopt the technology-forcing standards into their rules, but consider their adoption later, as the effective date nears, in light of intervening technical developments.

3. The districts adopt the technology-forcing standards into their rules now, but specify that the emission reductions associated with the technology-forcing limits are to be used toward attainment of the state ambient air quality standards, and not the federal standards. Under this approach, the technology-forcing limits would not become part of the SIP.

D. Prohibition of Sales

The determination contains an optional prohibition of sales provision. The prohibition of sales provision disallows the sales of noncompliant adhesives and sealants within the boundary of a district. This provision may be necessary in some districts to address the difficulty of regulating adhesive and sealant area or non-permitted sources. With the exception of the South Coast AQMD, all of the districts with adhesives rules have adopted a sales prohibition.

Adhesive and sealant emission sources may be classified as point sources and area sources. Districts can regulate emissions from point sources through permit conditions. Thus, compliance with a rule's requirements can be effectively enforced. However, in some districts, over 90 percent of adhesive and sealant usage falls into the area source category (Ventura County APCD, June 8, 1993, p.5). The prohibition of sales provision encourages compliance by greatly reducing the availability of noncompliant adhesives and sealants within the district's boundary.

There are several exemptions to the sales prohibition requirements. Sales of noncompliant adhesives are allowed for use outside the district or to a user who has installed a district approved VOC add-on control device. A manufacturer is not considered liable for the sales of noncompliant adhesives if an accurate compliance statement was provided on the label and if the product was not sold directly to a user or a sales outlet within a district. A manufacturer is also not liable for products sold to an independent distributor that is not a subsidiary of or under the direct control of the manufacturer.

The ARB's consumer products regulation applies statewide to the sale of four categories of adhesives: aerosol adhesives, contact adhesives, construction and panel adhesives, and general purpose adhesives. With the exception of aerosol adhesives (see page 4), the consumer products regulation applies only to products sold in containers with a net weight of one pound or less, or a net volume of 16 fluid ounces or less. The same products sold in larger containers fall under district jurisdiction. Because there are VOC limits for aerosol adhesives, contact adhesives, and multipurpose construction adhesives (equivalent to construction and panel adhesives) in the RACT/BARCT determination, districts are provided two options to ensure that overlap does not occur: 1) they may adopt the optional sales prohibition, which specifically exempts aerosol, contact, and multipurpose construction adhesives sold in smaller containers, or 2) they may adopt the exemption in section IV.A.8, which references the consumer products regulation.

III. CONTROL TECHNOLOGY

Two options for controlling VOC emissions from industrial adhesives and sealants are reformulation of adhesives, sealants, and cleanup solvents, and the use of add-on control equipment. Reformulation is the most cost-effective control method for VOC emissions from adhesives and sealants. Reformulation requires either an increase in the solids content or replacement of VOCs with water or exempt solvents. The RACT VOC limits for adhesives and sealants are based on currently available products.

Low-VOC and water-based adhesives sometimes require additional drying time, additional equipment (e.g., drying or application equipment), and special technical requirements (e.g., performance specification). In addition, the low-VOC and water-based adhesives are occasionally not as durable as their original solvent-based formulations.

Although reformulation is more cost-effective, some facilities may choose to install add-on control equipment to continue using noncomplying products for specific performance standards. Carbon adsorption and incineration are the most commonly used control methods for organic emissions. Control equipment is required to meet an 85 percent overall control efficiency, which is the product of capture efficiency and destruction efficiency.

While both carbon adsorption and incineration systems achieve high control efficiencies, they require large capital investments and high operating costs. These expenses make it economically infeasible for small facilities to install add-on control equipment.

IV. COST-EFFECTIVENESS

A. Cost of Compliant Adhesives and Sealants

Staff expects that most facilities will use compliant, low-VOC or water-based adhesives and sealants to comply with the determination's requirements. Even before district adhesives rules were adopted, some facilities were already using water-based products to lower insurance premiums and cleanup costs and improve worker safety (Ventura County APCD, 1993, p. 11). The cost of compliant adhesives and sealants is usually higher than the cost of a similar high-VOC formulation. However, since water-based adhesives usually have greater coverage, the cost differential is narrower than the retail price alone suggests (see Table 2).

Table 2
Comparison of Costs Between Water-based
and Solvent-Based Adhesives

Adhesives	Type[1]	Price ($/gal)	Coverage (sq.ft/gal)	Cost (cents/sq.ft)
DAP Weldwood Contact Cement[2]	W	22.54	450	5.0
DAP Weldwood Contact Cement[2]	S	17.86	140	12.7
Miracle Carpet Adhesives[2]	W	14.97	175	8.5
Roberts Carpet Adhesives[2]	S	13.93	148	9.4
Water-based Contact Adhesives[3]	W	19.35	421	4.6
Solvent-based Contact Adhesives[3]	S	13.31	308	4.3

[1]Adhesive type: W = Water-based; S = Solvent-based
[2]Based on staff's survey of Home Depot in Sacramento on January 20, 1994.
[3]Ventura County APCD Staff, 1993, p. 12.

The cost of using compliant adhesives and sealants is more involved than the difference in retail price. Usually, more drying time is required since there are few or no VOCs in the formulation, and the use of drying equipment may be necessary. The increased cost of compliant adhesives and sealants and drying equipment is offset somewhat due to decreased cleanup costs and insurance liability premiums. Ventura County APCD staff estimated the costs for a laminating shop to convert to water-based adhesives (Ventura County APCD, 1993, pp. 11-12).

District staff determined that the annualized cost for the conversion was about $2,300 for this facility with an annual use of 1,154 gallons of water-based adhesive.

B. Cost of Add-On Control Technology

Facilities may elect to comply with the determination's requirements by using add-on control equipment. Staff expects most users will not select this option due to the availability of compliant adhesives, especially those that will meet the RACT standards, and due to the high cost of installing and operating the control equipment. A cost estimate is presented here for comparative purposes.

In developing Rule 1168 and Rule 1136 (Wood Products Coatings), the South Coast AQMD provided cost estimates for add-on control equipment. The South Coast AQMD estimated the cost of installing and operating a carbon adsorption unit and an afterburner unit to be about $30,000 per year (South Coast AQMD, 1989, pp. F1-F4) and $380,000 per year (South Coast AQMD, 1988, pp. E3-E6, E23), respectively (in 1995 dollars).

C. Cost-effectiveness

As mentioned, the cost of complying with the determination reflects the cost of using alternative formulations of low-VOC or water-based adhesives, sealants, and cleanup products. Ventura County APCD staff determined that the cost-effectiveness of their adhesives rule ranges from a savings of $0.53 per pound to a cost of $1.16 per pound of VOC reduced (Ventura County APCD, 1996, p. 6). At a cost-effectiveness of $4.50 to $55.00 per pound of VOC reduced, the use of add-on control equipment to comply with the requirements of the determination will not be cost-effective for most sources, especially small businesses.

V. IMPACTS

A. Economic Impacts

Staff does not expect any negative economic impacts on the state's economy due to the adoption and implementation of this determination. As discussed, most adhesive and sealant manufacturers have already reformulated their products to comply with existing district adhesives and sealants rules. Since the manufacturers have absorbed the costs of reformulation, sharp increases in adhesive and sealant prices are not likely, especially for products required to meet the RACT VOC limits. Although water-borne products cost slightly more than solvent-borne products, water-borne products typically have a lower cost per square foot of coverage.

Based on surveys of retail outlets, the availability of compliant adhesives and sealants is adequate for some applications. The availability of specialty adhesives and sealants has increased as more districts have adopted and implemented adhesives and sealants rules and as enforcement has become more effective. The impact on consumers using products manufactured with adhesives and sealants will also be minimal. According to Bay Area AQMD staff, a number of businesses have indicated that they will try to absorb any increase in cost (Bay Area AQMD,

1992, p. 8).

B. Emission Reductions

The ARB emission inventory estimates total industrial adhesive and sealant emissions in California to be about 45 tons per day (t/d). Solvent-based adhesive and sealant emissions are estimated to be about 35 t/d of VOC, and water-based adhesive and sealant emissions are about 10 t/d of VOC. The RACT/BARCT determination's focus is only on emissions from solvent-based adhesives and sealants, since their emission reduction potential is much greater than that of water-based products.

The emission reductions from adhesives and sealants would be achieved mainly due to the switch from high-VOC to low-VOC products rather than from the use of costly add-on control devices. Based on calculations by Ventura County APCD staff (Ventura Co. APCD, 1993, p. 9), we estimate that emission reductions achieved by statewide compliance with the VOC limits in the RACT/BARCT determination will range from approximately 29 to 35 t/d. Of the reformulation options, the greatest emission reductions would be achieved by switching to 100 percent solid adhesives and sealants, followed by switching to water-based products. However, these options may not always be practical or possible. Emission reductions at the lower end of the range would be achieved by using low-VOC adhesives and sealants. The majority of the emission reductions will be achieved by existing district rules.

C. Socioeconomic Impacts

The RACT/BARCT determination would directly affect facilities that use or sell adhesives. These facilities include wood product manufacturers, upholstery shops, adhesives retailers, and architectural trades, such as building construction, floor covering installation, and roof repair. However, the determination is not expected to have a negative impact on employment or the economy. Most affected facilities in California are already subject to existing district adhesives and sealants rules. In addition, the costs associated with the determination should not create significant financial impacts for the affected facilities. Capital expenditures exceeding $5,000 are not expected. Most businesses can comply with the limits by using complying adhesives, which obviates the need for add-on controls.

D. Other Impacts

We have identified no adverse environmental impacts associated with implementation of this determination with respect to global warming, plant and animal life, noise levels, light and glare, land use, and natural resources.

VI. REFERENCES

1. Air Resources Board, California Clean Air Act Guidance for Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology, Sacramento, California, March 1990.

2. Air Resources Board, ARB-CAPCOA Suggested Control Measure for Architectural Coatings, Sacramento, California, July 1989.

3. Air Resources Board, Determination of Reasonably Available Control Technology for Metal Parts and Products Coating Operations, Sacramento, California, December 10, 1992.

4. Bay Area Air Quality Management District, Staff Report - Regulation 8, Rule 51, Adhesive and Sealant Products, San Francisco, California, October 1, 1992

5. South Coast Air Quality Management District, Staff Report - Rule 1168, Control of Volatile Organic Compound Emissions from Adhesive Application, El Monte, California, March 1989.

6. South Coast Air Quality Management District, Staff Report - Rule 1136, Wood Products Coatings, El Monte, California, April 19, 1988.

7. Ventura County Air Pollution Control District, Staff Report - Rule 74.20, Adhesives and Sealants, Ventura, California, June 8, 1993.

8. Ventura County Air Pollution Control District, Staff Report - Proposed Amendments to Rule 74.20, Adhesives and Sealants, Ventura, California, October 16, 1996.

APPENDIX A

DRAFT PROPOSED RACT/BARCT DETERMINATION FOR ADHESIVES AND SEALANTS

I. APPLICABILITY

This determination (rule) is applicable to any person who supplies, sells, offers for sale, or uses adhesives, sealants, or adhesive or sealant primers.[1] All provisions in this determination (rule), unless otherwise indicated, shall become effective on (12 months after the adoption date). All provisions are RACT unless otherwise specified as BARCT.

II. DEFINITIONS

For the purpose of this determination (rule), the following definitions apply:

A. ACRYLONITRILE-BUTADIENE-STYRENE (ABS) WELDING ADHESIVE is any adhesive intended by the manufacturer to weld acrylonitrile-butadiene-styrene (ABS) pipe. ABS pipe is made by reacting monomers of acrylonitrile, butadiene, and styrene and is normally identified with an ABS marking.

B. ADHESIVE is any substance that is used to bond one surface to another surface by attachment.

C. ADHESIVE PRIMER is any product intended by the manufacturer to be applied to a substrate, prior to the application of an adhesive, to provide a bonding surface.

D. AEROSOL ADHESIVE is a mixture of rubber, resins, and liquid and gaseous solvents and propellants packaged in a disposable container for hand-held application.

E. ARCHITECTURAL SEALANT/PRIMER is any sealant or sealant primer intended by the manufacturer to be applied to stationary structures, including mobile homes, and their appurtenances. Appurtenances to an architectural structure include, but are not limited to: hand railings, cabinets, bathroom and kitchen fixtures, fences, rain gutters and downspouts, and windows.

F. AUTOMOTIVE GLASS ADHESIVE PRIMER is any adhesive primer intended by the manufacturer to be applied to automotive glass prior to installation with an adhesive/sealant. This primer improves adhesion to the pinch weld and blocks ultraviolet light.

G. CERAMIC TILE INSTALLATION ADHESIVE is any adhesive intended by the manufacturer for the installation of ceramic tiles.

1. Adoption of the sales prohibition is at the discretion of the District.

H. CHLORINATED POLYVINYL CHLORIDE (CPVC) WELDING ADHESIVE is any adhesive intended by the manufacturer for the welding of CPVC plastic pipe. CPVC plastic is a polymer of the monomer that contains 67 percent chlorine and is normally identified with a CPVC marking.

I. COMPUTER DISKETTE JACKET MANUFACTURING ADHESIVE is any adhesive intended by the manufacturer to glue the fold-over flaps to the body of a vinyl computer diskette jacket.

J. CONTACT ADHESIVE is any adhesive intended by the manufacturer to adhere to itself instantaneously upon contact. The adhesive is applied to both adherends and allowed to become dry, which develops a bond when the adherends are brought together without sustained pressure. For the purpose of this determination (rule), products that qualify as a contact adhesive using the above definition, and that are labeled exclusively for only one of the following applications, shall not be required to meet the VOC limit for "Contact Adhesive" in Subsection III.A:

(1.) Single-ply roof membrane installation/repair
(2.) Bonding of immersible products
(3.) Bonding of flexible vinyl to flexible vinyl

K. COVE BASE INSTALLATION ADHESIVE is any adhesive intended by the manufacturer for the installation of cove base (or wall base), which is generally made of vinyl or rubber, on a wall or vertical surface at floor level.

L. DRY WALL INSTALLATION is the installation of gypsum dry wall to studs or solid surfaces using an adhesive formulated for that purpose.

M. EXEMPT COMPOUND is any of the following compounds: carbon monoxide, carbon dioxide, carbonic acid, metallic carbides, metallic carbonates, ammonium carbonate, methane, methylene chloride (dichloromethane), 1,1,1-trichloroethane (methyl chloroform), trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), 1,1,2-trichloro- 1,2,2-trifluoroethane (CFC-113), 1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114), chloropentafluoroethane (CFC-115), chloro-
difluoromethane (HCFC-22), 1,1,1-trifluoro-2,2-dichloroethane (HCFC-123), 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124), 1,1-dichloro-1-fluoroethane (HCFC-141b), 1-chloro-1,1-difluoroethane (HCFC-142b), trifluoromethane (HFC-23), pentafluoroethane (HFC-125), 1,1,2,2-tetrafluoroethane (HFC-134), 1,1,1,2-tetrafluoroethane (HFC-134a), 1,1,1-trifluoroethane (HFC-143a), 1,1-difluoroethane (HFC-152a), cyclic, branched, or linear completely methylated siloxanes, acetone, ethane, parachlorobenzotrifluoride (1-chloro-4-trifluoro-methylbenzene), and the following classes of perfluorocarbons: (A) cyclic, branched, or linear, completely fluorinated alkanes; (B) cyclic, branched, or linear, completely fluorinated ethers with no unsaturations; (C) cyclic, branched, or linear, completely

fluorinated tertiary amines with no unsaturations; and (D) sulfur- containing perfluorocarbons with no unsaturations and with the sulfur bonds to carbon and fluorine.

N. FLEXIBLE VINYL is nonrigid polyvinyl chloride plastic with at least five percent, by weight, of plasticizer content. A plasticizer is a material, such as a high boiling point organic solvent, that is incorporated into an adhesive to increase its flexibility, workability, or distensibility, and may be determined using ASTM Method E260-91 or from product formulation data.

O. FIBERGLASS is fine filaments of glass.

P. FOAM is a rigid or spongy cellular mass with gas bubbles dispersed throughout.

Q. GRAMS OF VOC PER LITER OF ADHESIVE, LESS WATER AND LESS EXEMPT COMPOUNDS is the weight of VOC per combined volume of VOC and adhesive solids, and can be calculated by the following equation:

Grams of VOC per Liter of Adhesive, Less Water and Less Exempt Compounds =

$$\frac{W_s - W_w - W_e}{V_m - V_w - V_e}$$

Where: W_s = weight of volatile compounds, in grams
W_w = weight of water, in grams
W_e = weight of exempt compounds, in grams
V_m = volume of material, in liters
V_w = volume of water, in liters
V_e = volume of exempt compounds, in liters

R. GRAMS OF VOC PER LITER OF MATERIAL is the weight of VOC per volume of material and can be calculated by the following equation:

Grams of VOC per Liter of Material = $\frac{W_s - W_w - W_e}{V_m}$

Where: W_s = weight of volatile compounds, in grams
W_w = weight of water, in grams
W_e = weight of exempt compounds, in grams
V_m = volume of material, in liters

S. HOUSEHOLD ADHESIVE is any adhesive subject to Title 17, California Code of Regulations, sections 94507-94517 (Consumer Products). Household adhesives do

not include units of product, less packaging, which weigh more than one pound or consist of more than 16 fluid ounces.

T. INDOOR FLOOR COVERING INSTALLATION ADHESIVE is any adhesive intended by the manufacturer for the installation of wood flooring, carpet, resilient tile, vinyl tile, vinyl backed carpet, resilient sheet and roll, or artificial grass. Ceramic tile installation is excluded from this category.

U. LAMINATE is a product made by bonding together two or more layers of material.

V. LOW-SOLIDS ADHESIVE, SEALANT, OR PRIMER is any product that contains 120 grams or less of solids per liter of material.

W. MARINE DECK SEALANT/SEALANT PRIMER is any sealant or sealant primer intended by the manufacturer to be applied to wooden marine decks.

X. METAL TO URETHANE/RUBBER MOLDING OR CASTING ADHESIVE is any adhesive intended by the manufacturer to bond metal to high density or elastomeric urethane or molded rubber materials, in heater molding or casting processes, to fabricate products such as rollers for computer printers or other paper handling equipment.

Y. MULTIPURPOSE CONSTRUCTION ADHESIVE is any adhesive intended by the manufacturer for the installation or repair of various construction materials, including but not limited to drywall, subfloor, panel, fiberglass reinforced plastic (FRP), ceiling tile, and acoustical tile.

Z. NONMEMBRANE ROOF INSTALLATION/REPAIR ADHESIVE is any adhesive intended by the manufacturer for the installation or repair of nonmembrane roofs and that is not intended for the installation of prefabricated single-ply flexible roofing membrane. This category includes plastic or asphalt roof cement, asphalt roof coatings, and cold application cement.

AA. OUTDOOR FLOOR COVERING INSTALLATION ADHESIVE is any adhesive intended by the manufacturer for the installation of floor covering that is not in an enclosure and is exposed to ambient weather conditions during normal use.

BB. PANEL INSTALLATION is the installation of plywood, pre-decorated hardboard (or tileboard), fiberglass reinforced plastic, and similar pre-decorated or non-decorated panels to studs or solid surfaces using an adhesive formulated for that purpose.

CC. PERCENT VOC BY WEIGHT is the ratio of the weight of the VOC to the weight of the material, expressed as a percentage of VOC by weight. The percent VOC by weight can be calculated as follows:

$$\%\text{VOC weight} = \frac{W_v}{W} \times 100$$

Where: W_v = Weight of VOCs in grams
W = Weight of material in grams

DD. PLASTIC CEMENT WELDING ADHESIVE is any adhesive made of resins and solvents that is formulated to dissolve the surfaces of plastic to form a bond between mating surfaces.

EE. PLASTIC CEMENT WELDING ADHESIVE PRIMER is any primer intended by the manufacturer to prepare plastic substrates prior to bonding or welding.

FF. PLASTIC FOAM is a foam constructed of plastics.

GG. PLASTICS are various synthetic materials chemically formed by the polymerization of organic (carbon-based) substances.

HH. POLYVINYL CHLORIDE (PVC) WELDING ADHESIVE is any adhesive intended by the manufacturer for the welding of PVC plastic pipe. PVC plastic is a polymer of the chlorinated vinyl monomer that contains 57 percent chlorine and which is normally identified with a PVC marking.

II. POROUS MATERIAL is a substance that has tiny openings, often microscopic, in which fluids may be absorbed or discharged. Such materials include but are not limited to wood, paper, and corrugated paperboard. For the purpose of this determination (rule), porous material does not include plastic foam.

JJ. PROPELLANT is a fluid under pressure that expels the contents of a container when a valve is opened.

KK. ROADWAY SEALANT is any sealant intended by the manufacturer to be applied to public streets, highways, and other surfaces, including but not limited to curbs, berms, driveways, and parking lots.

LL. RUBBER includes any natural or manmade rubber substrate, including but not limited to: styrene-butadiene rubber (SBR), polychloroprene (neoprene), butyl rubber, nitrile rubber, chlorosulfonated polyethylene (CSM), and ethylene propylene diene terpolymer (EPDM).

MM. SEALANT PRIMER is any product intended by the manufacturer to be applied to a substrate, prior to the application of a sealant, to enhance the bonding surface.

NN. SEALANT is any material with adhesive properties that is formulated primarily to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces. Sealants include

sealant primers and caulks.

OO. SINGLE-PLY ROOF MEMBRANE is single sheets of rubber, normally EPDM (ethylene-propylene diene monomer), that are applied in a single layer to a building roof (normally a flat roof).

PP. SINGLE-PLY ROOF MEMBRANE INSTALLATION/REPAIR ADHESIVE is any adhesive intended by the manufacturer for the installation or repair of single-ply roof membrane. Installation includes, as a minimum, attaching the edge of the membrane to the edge of the roof and applying flashings to vents, pipes, and ducts that protrude through the membrane. Repair includes gluing the edges of tears together, attaching a patch over a hole, and reapplying flashings to vents, pipes, or ducts installed through the membrane.

QQ. SINGLE-PLY ROOF MEMBRANE ADHESIVE PRIMER is any primer intended by the manufacturer to clean and promote adhesion of the single-ply roof membrane seams or splices prior to bonding.

RR. SINGLE-PLY ROOF MEMBRANE SEALANT is any sealant intended by the manufacturer to be applied to single-ply roof membrane.

SS. STRUCTURAL GLAZING ADHESIVE is any adhesive intended by the manufacturer to adhere glass, ceramic, metal, stone, or composite panels to exterior building frames.

TT. SUBFLOOR INSTALLATION is the installation of subflooring material over floor joists, including the construction of any load bearing joists. Subflooring is covered by a finish surface material.

UU. SURFACE PREPARATION SOLVENT is a solvent used in the cleaning of a substrate to remove dirt, oil, and other contaminants. This surface cleaning is typically done prior to the application of primers, adhesives, or sealants.

VV. THIN METAL LAMINATING ADHESIVE is any adhesive intended by the manufacturer to bond multiple layers of metal to metal or metal to plastic in the production of electronic or magnetic components in which the thickness of the bond line(s) is less than 0.025 mils.

WW. TIRE REPAIR is the expanding of a hole, tear, fissure, or blemish in a tire casing by grinding or gouging, applying adhesive, and filling the hole or crevice with rubber.

XX. TIRE RETREAD ADHESIVE is any adhesive intended by the manufacturer to be applied to the back of precure tread rubber and to the casing and cushion rubber. It may also be used to seal buffed tire casings to prevent oxidation while the tire is being prepared for a new tread.

YY. TRAFFIC MARKING TAPE is preformed reflective film intended by the

manufacturer to be applied to public streets, highways, and other surfaces, including but not limited to curbs, berms, driveways, and parking lots.

ZZ.TRAFFIC MARKING TAPE ADHESIVE PRIMER is any primer intended by the manufacturer to be applied to surfaces prior to installation of traffic marking tape.

AAA. VCT means vinyl composition tile.

AAB. VOLATILE ORGANIC COMPOUND (VOC) is any compound containing at least one atom of carbon, excluding exempt compounds (see definition M).

III. REQUIREMENTS

A. Standards: A person shall not apply adhesives, sealants, or adhesive or sealant primers that have a VOC content (gram/liter [g/l], less water and exempt compounds) in excess of the following limits (for low-solids adhesives, sealants, or primers, the VOC content is based on a g/l of material basis):

		VOC LIMITS (g/l)	BARCT VOC LIMITS (Effective 1/1/98) (g/l)
(1)	Adhesives:		
	ABS welding	400	
	Ceramic tile installation	150	130
	Computer diskette jacket manufacturing	850	
	Contact	200	
	Cove base installation	200	150
	CPVC welding	490	
	Indoor floor covering installation	150	
	Metal to urethane/rubber molding or casting	850	250*
	Multipurpose construction	200	
	Nonmembrane roof installation/repair	300	
	Other plastic cement welding	510	
	Outdoor floor covering installation	250	
	PVC welding	510	
	Single-ply roof membrane installation/repair	650	250
	Structural glazing	100	
	Thin metal laminating	780	250*
	Tire retread	100	
(2)	Sealants:		
	Architectural	250	
	Marine deck	760	
	Nonmembrane roof installation/repair	300	
	Roadway	250	
	Single-ply roof membrane	450	
	Other	420	

* These are technology forcing standards. Technology forcing standards are standards which may not be met at the present time and have future effective dates. It is anticipated that adhesives technology will advance sufficiently to meet these standards by the time these standards go into effect.

	VOC LIMITS (g/l)	BARCT VOC LIMITS (Effective 1/1/98) (g/l)
(3) Adhesive Primers:		
Automotive glass	700	
Plastic cement welding	650	
Single-ply roof membrane	650	250*
Traffic marking tape	550	150
Other	250	
(4) Sealant Primers:		
Architectural		
- Non porous	250	
- Porous	775	
Marine deck	760	
Other	750	
(5) Adhesives Application Onto Substrate:		
Flexible vinyl to flexible vinyl	660	250
Flexible vinyl to any other substrate	250	
Fiberglass	200	
Metal	30	
Plastic foam	120	
Porous material (except plastic foam)	150	120
Rubber	650	250
Other substrates	250	

If an adhesive is used to bond dissimilar substrates together, except for bonding flexible vinyl to any other substrate, the applicable substrate category with the highest VOC content shall be the limit for that operation.

If an operator uses an adhesive or sealant subject to section III.A.(1), III.A.(2), III.A.(3), or section III.A.(4), the requirement in that section is applicable rather than that in section III.A.(5).

B. Aerosol Adhesives: A person shall not use any aerosol adhesive unless the VOC content, including the propellant, does not exceed 75 percent by weight. Effective 1/1/2002, the VOC content of aerosol adhesives shall not exceed 25 percent by weight.*

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* These are technology forcing standards. Technology forcing standards are standards which may not be met at the present time and have future effective dates. It is anticipated that adhesives technology will advance sufficiently to meet these standards by the time these standards go into effect.

C. Cleanup Solvent:

(1) No person shall use materials containing VOC for the removal of adhesives, sealants, or adhesive or sealant primers from surfaces, other than spray application equipment, unless the composite vapor pressure of the solvent used is less than
45 mm of Hg at 20^0 C.

(2) Spray application equipment: Either one of the following shall be used for cleaning, flushing or soaking of filters, flushing lines, pipes, pumps, and other parts of the application equipment:

(a) An enclosed cleaning system, or an equivalent cleaning system as determined by the test method referenced in section VI.H,[2] or

(b) A solvent with a VOC content of 70 grams of VOC per liter of material, or less. Parts containing dried adhesive may be soaked in an organic solvent as long as the composite vapor pressure, excluding water, of the solvent is
9.5 mm of Hg at 20^0 C or less and is kept in a closed container, which shall be closed except when depositing or removing parts or materials from the container.

D. Surface Preparation Solvent: No person shall use materials containing VOCs for surface preparation, except for single-ply roofing, unless the VOC content of the solvent is less than 70 g/l, except for single-ply roofing. The composite vapor pressure of the surface preparation solvent used for single-ply roofing shall not exceed 45 mm of Hg at 20^0 C effective (date of adoption).

E. A person may comply with the provisions of subsections III.A, B, C, and D by using approved add-on air pollution control equipment, provided that:

(1) The VOC emissions from such operations and/or materials are reduced by at least 85 percent overall capture and destruction efficiency, by weight,

(2) Combustion temperature is continuously monitored when operating a thermal incinerator,

(3) Inlet and exhaust gas temperatures are continuously monitored when operating a catalytic incinerator,

(4) Control device efficiency is continuously monitored when operating a carbon adsorber or control device other than a thermal or catalytic incinerator, and

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2. Adoption of section III.C.(2).(a) is at the discretion of the district.

(5) Written approval for such equipment, in the form of an Authority to Construct and a Permit to Operate, is received from the Executive Officer.

F. Storage of VOC Containing Materials: All VOC containing materials, including VOC-laden cloth or paper used in stripping cured adhesives, shall be stored or disposed in non-absorbent containers, which shall be closed except when depositing or removing materials from the container.

G. Prohibition of Sales:[3]

(1) Except as provided in subsections III.G.(3) and III.G.(4) after the specified effective dates, no person shall supply, sell, or offer for sale any adhesive, sealant, or adhesive or sealant primer which, at the time of sale, exceeds the corresponding VOC limit listed in subsections III.A.(1), (2), (3), or (4) and is defined under a product category in those subsections. This provision only applies to products that are supplied to or sold to persons within the District.

(2) Except as provided in subsections III.G.(3) and III.G.(4), no person shall supply, sell, or offer for sale, any aerosol adhesive which, at the time of sale, exceeds the VOC limits listed in subsection III.B. after the specified effective dates.

(3) The sales prohibition in subsections III.G.(1) and III.G.(2) shall not apply to any supplier or seller of any adhesive, sealant, or adhesive or sealant primer as follows:

(a) Any adhesive shipped outside of the District for use outside of the District.

(b) The sale of adhesives to a user who has installed a District permitted VOC add-on control device.

(4) The sales prohibition in subsections III.G.(1) and III.G.(2) shall not apply to any manufacturer of any adhesive, sealant, or adhesive or sealant primer if the manufacturer has provided the maximum VOC content per subsection III.H and if:

(a) The product was not sold directly to a user or a sales outlet located in the District, or

(b) The product was sold to an independent distributor that is not a subsidiary of, or under the direct control of, the manufacturer.

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3. Adoption of section III.G is at the discretion of the District.

(5) The sales prohibition in subsections III.G.(1) and III.G.(2) shall not apply to the sale of any contact, multipurpose construction, or aerosol adhesive if:

(a) The product is sold in any container(s) having a capacity of 16 fluid ounces or less (net volume) or one pound or less (net weight); and

(b) The total net weight or volume of two or more containers packaged together must be equal to or less than one pound or 16 fluid ounces, respectively, to qualify for this exemption.

H. Compliance Statement Requirement: The manufacturer of any adhesive, sealant, or adhesive or sealant primer subject to this determination shall display the maximum VOC content as supplied from the appropriate test method, on labels or containers. This designation shall display recommendations regarding thinning, reducing, or mixing with any other VOC containing material. This information shall include the maximum VOC content on an as-applied basis when used in accordance with the manufacturer's recommendations.

I. Prohibition of Specification: No person shall solicit, require for use, or specify the application of any adhesive, primer, or sealant if such use or application results in a violation of the provisions of this determination (rule). This prohibition shall apply to all written or oral contracts.

IV. EXEMPTIONS

A. The provisions of this determination (rule) shall not apply to the following:

(1) Adhesives used in tire repair operations, provided a label on the adhesive used states "For Tire Repair Only."

(2) Adhesives used in the assembly and manufacturing of undersea-based weapon systems.

(3) Adhesives, sealants, adhesive primers or sealant primers being tested or evaluated in any research and development, quality assurance, or analytical laboratory, provided that the following records are maintained and made available to District personnel for a period of at least two years:

(a) A list of all such materials used, which at a minimum includes the manufacturer’s identification, the product category of the material or type of application, and the VOC content of each material.

(b) Such records shall be retained in accordance with the provisions of section V of this determination (rule).

(4) Solvent welding operations used in the manufacturing of medical devices.

(5) Plaque laminating operations where adhesives are used to bond a clear, polyester

acetate laminate to wood with lamination equipment installed prior to July 1, 1992. Any person seeking to claim this exemption shall notify the Executive Officer in writing that a complying adhesive is not available.

(6) Adhesives and sealants that are regulated by other District rules.

(7) Adhesives and sealants that contain less than 20 grams of VOC per liter of adhesive or sealant, less water and less exempt compounds, as applied.

(8) Adhesives that are subject to Title 17, California Code of Regulations, sections 94507-94517 (Consumer Products).[4]

(9) [Reserved for specific exemptions determined by the APCO to be technologically infeasible or not cost-effective to retrofit]

B. The provisions of this determination (rule), except Section III.G (Prohibition of Sales), shall not apply if the total VOC emissions from all adhesives, sealants, adhesive primers and sealant primers applied at the stationary source are less than 200 lb per calendar year (or an equivalent volume). Any person claiming this exemption shall record and maintain monthly operational records that can substantiate this claim.[5]

C. The provisions of section III.A and III.B shall not apply to the use of any adhesive, sealant, or adhesive or sealant primer provided the total volume of noncomplying adhesives, sealants, and primers applied facility-wide does not exceed 55 gallons per calendar year. Any person seeking to claim this exemption shall notify the Executive Officer in writing, for each formulation, that a complying adhesive, sealant, or primer is not available. Any person claiming this exemption shall record and maintain monthly operational records that can substantiate this claim.[6]

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4. Adoption of section IV.A.(8) is at the discretion of the District. If the District does not adopt the Prohibition of Sales (III.G), this exemption should be adopted.
5. Adoption of section IV.B is at the discretion of the District.
6. Adoption of section IV.C is at the discretion of the District. If the District adopts the Prohibition of Sales (III.G), this exemption should only be granted for the use of adhesives subject to section III.A.(5).

V. ADMINISTRATIVE REQUIREMENTS

A. Recordkeeping - Any person subject to this determination (rule) shall:

(1) Maintain a current list of each adhesive, sealant, adhesive or sealant primer, and solvent in use and in storage. The file shall provide all of the data necessary to evaluate compliance and shall include, but not limited to, the following information, as applicable:

(a)A data sheet or material list giving the material name, manufacturer identification, and material application.

(b) Any catalysts, reducers, or other components used and the mix ratio.

(c) The applicable VOC content limit or vapor pressure limit from section III and the actual VOC content, as applied, or vapor pressure of the adhesive, sealant, primer, or solvent.

(2) Maintain records of the monthly volume of each adhesive, sealant, primer, or solvent used.

(3) When compliance is achieved through the use of add-on control equipment, maintain records on a daily basis of key operating parameters for the emission control equipment, including, but not limited to:

(a) Hours of operation

(b) Routine and nonroutine maintenance

(c)The applicable information specified in section III.E.

(d) The daily volume of each noncompliant adhesive, sealant, primer, or solvent used.

(4) All records shall be maintained for at least two (2) years and shall be available for inspection.

VI. TEST METHODS

A. The VOC and solids content of all nonaerosol adhesives, adhesive primers, and cleaning solvents, except as specified in section VI.D., shall be determined using U.S. EPA Reference Method 24 (40 CFR Part 60, Appendix A) or South Coast AQMD Method 304.

B. Exempt organic compounds shall be determined using ASTM D4457-85. For exempt compounds where no reference test method is available, a facility requesting the exemption shall

provide appropriate test methods approved by the Executive Officer and approvable by the U.S. EPA.

C. The VOC content of aerosol adhesives shall be determined using ARB Method 310. The VOC content of aerosol adhesive primers shall be determined using ARB Method 310 or South Coast AQMD Method 305 for Aerosol Coatings.

D. The VOC content of any plastic welding cement adhesive or primer shall be determined using South Coast AQMD Method 316A.

E. The measurement of the VOC content of adhesives containing cyanoacrylate shall be determined using (proposed) South Coast AQMD Method ___.

F. The composite vapor pressure of organic compounds in cleaning materials shall be determined by quantifying the amount of each compound in the blend using gas chromatographic analysis (ASTM E 260-91) for organics and ASTM D3792-79 for water content, if applicable, or by using product formulation data, and by summing the partial pressures of each compound at 20^0 C. For the purpose of this calculation, Raoult's Law applies to the blend. The vapor pressure of each single component compound may be determined from ASTM D2879-86 or may be obtained from a published source approved by the Executive Officer, such as the sources referenced in 40 CFR 52.741.

G. The measurement of capture efficiency of an emission control system shall be conducted and reported in accordance with U.S. EPA protocols referenced in 55 CFR 26865, June 29, 1990, the recently approved U.S. EPA Technical Document "Guidelines for Determining Capture Efficiency," issued January 9, 1995, or a district capture efficiency determination method approved by the U.S. EPA.

H. The measurement of control efficiency shall be in accordance with U.S. EPA Methods 25, 25A, 25B, or ARB Method 100.

I. The active and passive solvent losses from spray gun cleaning systems shall be determined using South Coast AQMD's "General Test Method for Determining Solvent Losses from Spray Gun Cleaning Systems," dated October 3, 1989. The test solvent for this determination shall be any lacquer thinner with a minimum vapor pressure of 105 mm of Hg at 20^0 C, and the minimum test temperature shall be 15^0 C.

APPENDIX B

DISTRICTS WITH ADOPTED ADHESIVES AND SEALANTS RULES

DISTRICTS WITH ADOPTED ADHESIVES AND SEALANTS RULES
(as of February 1997)

Bay Area Air Quality Management District
Regulation 8, Rule 52 (Adopted November 18, 1992)

El Dorado County Air Pollution Control District
Rule 236 (Adopted July 25, 1995)

Placer County Air Pollution Control District
Rule 235 (Adopted June 8, 1995)

Sacramento Metropolitan Air Quality Management District
Rule 460 (Adopted January 9, 1997)

San Joaquin Valley Unified Air Quality Management District
Rule 4653 (Adopted March 17, 1994)

South Coast Air Quality Management District
Rule 1168 (Adopted April 7, 1989)

Ventura County Air Pollution Control District
Rule 74.20 (Adopted June 8, 1993)

Yolo-Solano Air Quality Management District
Rule 2.33 (Adopted September 14, 1994)

APPENDIX C

COMMENTS AND RESPONSES

Summary of Comments
on the
Draft Proposed RACT/BARCT Determination for Adhesives and Sealants

(Comments submitted in response to August 19, 1993 mailout of draft Table of Standards and to materials presented at workshops held on September 30 and October 5, 1993)

Comment 1: Air Quality Consultants, Inc. requested that an exemption be granted for nitrocellulose-base adhesive or that a higher VOC limit of 800 g/l be specified for this category. This adhesive, formulated in solution with acetone or in an alcohol/ether mixture, bonds by fusion welding and is used in the manufacture of combustible cartridge cases for military munitions. The extent to which the acetone solvent evaporates after application of the adhesive has not been determined. This is because there are very few sources and the flammable/ explosive nature of the product makes it costly and dangerously difficult to design an appropriate test.

Response: There is only one known source that uses nitrocellulose-based adhesives in California. It is not practical to exempt this product statewide because of such limited and specific usage. We recognize that for certain applications, complying products may not be available. The districts should consider such applications on a case-by-case basis. We also note that acetone is now exempt from the definition of VOC.

Comment 2: An industry representative stated that a number of solvents contain a significant amount of combined oxygen in their formulation (e.g., 50 percent oxygen in methyl alcohol, 33 percent oxygen in ethyl alcohol, 20 percent oxygen in MEK, etc.). It was proposed that in the emission inventory calculation, the combined oxygen should be subtracted from the total solvent weight since oxygen is not an oxidant precursor. Inclusion of the combined oxygen in the emission inventory calculation would lead to an over-estimation of the actual emissions attributed to these solvents.

Response: Oxygen is a component of the solvent molecule. Because the entire molecule is considered an ozone precursor, rather than the individual atoms making up the molecule, we believe that combined oxygen should not be subtracted from the total solvent weight.

Comment 3: Courtaulds Aerospace proposed adding a new category "sealant primer" with a VOC limit of 700 g/l.

Response: We have added the proposed category with a VOC limit of 750 g/l to section III.A.(4).

Comment 4: Courtaulds Aerospace also proposed changing the VOC limit for adhesive primer from 250 g/l to 450 g/l, since the former limit is not practical.

Response: We believe that the 250 g/l requirement is achievable based on discussions with industry. We recognize that for some special applications, complying products may not be available. The districts should consider such applications on a case-by-case basis.

Comment 5: Courtaulds Aerospace requested that industry be given the opportunity to test and comment on the feasibility of South Coast AQMD Method 316A once the test method is fully developed.

Response: Industry participated in an interlaboratory study of the proposed revised South Coast AQMD Method 316A. Results of this testing were used to revise the proposed limits for ABS, PVC, and CPVC welding cements.

Comment 6: DETCO proposed adding a new category of "deck seam primer" with a VOC limit of 760 g/l. The rationale for this request stems from the limited, but indispensible, quantity of this primer used in the application of two-component polysulfide caulks on the wooden decks of marine vessels. There is no known substitute and the primer is required to comply with military specifications.

Response: We have added the category “marine deck sealant primer” with a VOC limit of 760 g/l to section III.A.(4).

Comment 7: SPRI concurred with the proposed VOC limits for adhesives, sealants, and primers used in single ply roofing. However, they recommended that periodic meetings be arranged with SPRI to assess progress made regarding VOC limits.

Response: We encourage industry to inform us of their progress toward meeting the proposed VOC limits. Periodic meetings with industry are viewed as helpful and beneficial to the rule development process.

Comment 8: ACCO Industries proposed adding a new category "thin metal laminating" with a VOC limit of 780 g/l.

Response: We have added the proposed category and VOC limit to section III.A.(1). We also added a BARCT limit of 250 g/l, based on ongoing research in the development of compliant adhesives for this application.

Comment 9: ACCO Industries proposed adding exemptions for noncomplying adhesives for low usage or for products packaged in small containers.

Response: We have added a low usage provision, which is at the discretion of the district. Section IV.C exempts usage of less than 55 gallons of noncomplying products, applied facility-wide, per calendar year.

Comment 10: IRTA requested that the ARB staff ensure that regulatory development be uniform statewide and consistent with other states.

Response: The RACT/BARCT determination is intended to assist the districts in developing regulations to attain and maintain state and federal ambient air quality standards. The RACT/BARCT process is designed to minimize variations among the districts' rule requirements. In addition, the determination is intended to promote consistency of controls throughout the state for similar emissions sources within air basins with similar air quality attainment designations.

Comment 11: IRTA also requested that the ARB staff reevaluate the proposed VOC limits, particularly for wood product adhesives, in light of the upcoming ban on ozone-depleting substances (e.g., 1,1,1-TCA). Since many adhesives are currently formulated with ozone-depleting substances to comply with existing district rules, and because there are no alternatives that can be substituted universally, higher VOC limits must be allowed until viable substitutes become available.

Response: We believe that the proposed VOC limits are appropriate. For wood product adhesives, we agree with the commenter that the originally proposed VOC limit of 30 g/l was too low. Therefore, we have included these products in the porous materials category, with a VOC limit of 150 g/l. Based on discussions with industry, we believe that viable replacements that do not contain ozone-depleting substances will be available for other adhesives. Where replacements are not available, the districts have the option to examine possible exemptions on a case-by-case basis.

Comment 12: IRTA requested that the ARB staff be attentive to the promulgation of National Emissions Standards for Hazardous Air Pollutants (NESHAPs).

Response: The ARB staff is continuing to monitor NESHAPS development.

Comment 13: IRTA requested that the ARB staff coordinate with the districts regarding RACT requirements in district SIP revisions.

Response: The ARB staff reviews new and revised district rules before submitting them to the U.S. EPA for inclusion in the district's SIP revisions. The ARB staff advises the districts on deficiencies in the rules designed to meet the SIP requirements. This RACT/BARCT determination will assist the districts in developing rules that will satisfy their necessary SIP revisions.

Comment 14: IRTA recommended that ARB staff give priority to developing a RACT/BARCT determination for wood furniture coating operations. These operations use coatings, adhesives, and cleanup solvents that would be subject to future compliance dates in district rules and to NESHAPs. These compounds are also ozone-depleting substances.

Response: The U.S. EPA has published a NESHAP and issued a Control Techniques Guideline (CTG) for wood furniture coating operations. The NESHAP and CTG appear to provide an adequate technical basis for the determination of RACT and BARCT for these sources. Therefore, developing a RACT/BARCT determination for wood furniture coating operations is not a high priority.

Comment 15: IRTA also recommended that the ARB staff investigate individual applications of adhesives and sealants thoroughly prior to specifying broad limits.

Response: We believe the current limits are appropriate for the affected products and processes. This RACT/BARCT determination is the result of numerous contacts with both the suppliers and users of adhesives. Much consideration has been given to their needs and limitations. We have also held public workshops at various stages in the development of this determination to solicit comments, concerns, and possible improvements. In addition, much of this determination is based on existing district rules. These rules were researched extensively prior to their adoption and have been subsequently revised as needed to correct deficiencies. We have worked carefully with the districts' staffs in developing this determination, using their knowledge whenever possible.

Comment 16: IRTA also recommended that the ARB staff reevaluate both the definition and VOC limits for plastic foams and porous materials to avoid ambiguity, since plastic foams are porous materials.

Response: We have modified the definition of "porous material" to exclude plastic foam.

Comment 17: IRTA questioned the accuracy of the emission inventory presented by the ARB staff on both the total emissions (110 tons per year) and the contribution of water-based adhesives (almost 50 percent). They suggested that the inventory might be 110 tons per day and the emissions from water-based adhesives are much less than 50 percent of the total.

Response: In the February 1997 draft of the RACT/BARCT determination, we used the 1994 ARB emission inventory for adhesives, which is 45 tons per day. Emissions from water-based adhesives contribute 9 tons per day, or 20 percent, to the total adhesives emission inventory.

Comment 18: The W. W. Henry Company requested that the definition of VOC incorporate vapor pressure to clearly define volatile compounds. Such an approach is already used in the ARB consumer products regulation, which exempts compounds with a vapor pressure less than 0.1 mm Hg at 20^0 C, or which contain more than 12 atoms of carbon.

Response: The definition of VOC in the RACT/BARCT determination is consistent with that used in district rules.

Comment 19: The W. W. Henry Company requested that the word "panel" be deleted from the "drywall and panel installation" product category since there already is a panel adhesive definition.

Response: "Drywall installation" and "panel installation" are now defined separately within the definition of the "multipurpose architectural" category.

Comment 20: The W. W. Henry Company requested the ARB staff to include two additional categories (outdoor floor covering installation and vinyl backed floor covering installation) since these two categories are considerably different from each other and from other categories. They indicated that the South Coast AQMD rule currently provides different limits for these two product categories.

Response: We have added the category “outdoor floor covering installation" to section III.A.1. However, a category for vinyl backed floor covering products was not added because low-VOC floor covering products are available that will adhere to vinyl backed floor covering.

Comment 21: IPS Corporation requested harmonization of the VOC limits, test methods, and implementation dates among the state's air districts as well as the ARB's VOC regulation.

Response: See response to comment 10.

Comment 22: IPS Corporation recommended the adoption of South Coast AQMD Method 316A by rulemaking bodies throughout the state.

Response: Each district adopting the RACT/BARCT determination or using it as the basis for amending their rule would also adopt South Coast AQMD Method 316A.

Comment 23: IPS Corporation requested that the ARB revise the consumer products regulation and create a specific category for solvent cements and primers for plastic welding.

Response: We recently surveyed this category to determine the feasibility of developing standards for the consumer use of these products. The survey results showed that the emission reductions from regulating solvent cements and primers as consumer products would be marginal. We are not currently planning to include these categories in the consumer products regulation.

Comment 24: Beckman recommended a change in the language that exempts small users (section IV.C). The suggested language reads as follows: specify only a 55 gallon per year limit for the facility (removing the less than 10 gallons per year per stationary source).

Response: We have deleted the phrase "less than 10 gallons per year per stationary source."

Comment 25: C.G. Boyd & Associates, Inc. stated that there are too many changes in rules, making compliance more difficult. Industry cannot keep making engineering changes each time a rule becomes more stringent and they cannot keep making costly label changes.

Response: See response to comment 10.

Comment 26: G.A. Huber Co. requested that the ARB staff consider the needs of the low volume users of these adhesives until water-based, low-VOC alternatives can be developed.

Response: See response to comment 9.

Comment 27: G.A. Huber Co. requested that the ARB staff include in section III a product designation for molded rubber and elastomeric polyurethane products with a recommended VOC limit of 850 g/l. Alternatively, section IV.A could specify an exemption for molded rubber and elastomeric polyurethane products.

Response: We have added the proposed category and VOC limit to section III.A.(1).

Comment 28: Oatey endorsed the limits set in the draft proposal for these products, with the exception of the BARCT VOC limit of 450 g/l for plastic cement welding primers. Oatey has no knowledge of any technology available for a primer which meets this limit.

Response: We have deleted the BARCT VOC limit of 450 g/l for plastic cement welding primers.

Comment 29: Oatey also indicated that the ARB staff should clarify the relationship of this proposal to the existing consumer products regulation, which does not specifically address cements and primers for plastic welding. They requested that the consumer products regulation be modified to recognize this class of unique products and that limits consistent with the draft RACT/BARCT proposal be instituted.

Response: See response to comment 23.

Comment 30: National Aerosol Products Co. indicated that there is a wide variety of aerosol adhesives, each formulated for a specific use. Each type must be addressed separately, as with nonaerosol adhesives. It is not possible to have one VOC limit for all aerosol adhesives.

Response: Based on conversations with industry, we believe that low VOC aerosol replacements may be available by the compliance date. We recognize that there are unique aerosol products that may not meet the low VOC requirements. For those instances where replacements are not available, districts have the option to examine possible exemptions on a case-by-case basis.

Comment 31: National Aerosol Products Co. stated that the proposed July 1, 1995 effective date for the BARCT limit is not realistic for all aerosol products.

Response: We have changed the effective date to January 1, 2002, to be consistent with the ARB's Consumer Products Regulation.

Comment 32: 3M requested that the 25 percent by weight aerosol adhesive limit not be designated as BARCT because there is no assurance that 3M or any other adhesive manufacturer will be able to meet the standard by 1995. 3M also requested that a footnote be added to the effect that the standard is technology forcing and depends on anticipated technological breakthroughs.

Response: See response to Comment 31. We have added a footnote indicating that the 25 percent limit is technology-forcing.

Comment 33: "Another Tired Small Company" indicated that there are too many and too frequent changes in the rules and regulations. Also, they stated that the rule changes are occurring prior to the development and proven effectiveness of technology--both in chemical composition and materials handling in a practical manner.

Response: See response to comment 10. The RACT/BARCT determination acknowledges that the BARCT standards are technology-forcing and provides districts with options regarding their adoption.

Comment 34: Dames & Moore, representing Trus Jois Macmillan, stated that they cannot comply with the VOC content limit for wood (substrate) of 30 g/l.

Response: We have deleted the VOC limit of 30 g/l for wood products and have included wood as a porous material with a VOC limit of 150 g/l.

Comment 35: TREMCO stated that a 250 g/l VOC requirement for their architectural sealant primer is not feasible today.

Response: This particular product is considered a low-solid VOC sealant primer and therefore meets the VOC limit.

Comment 36: Advanced Polymer Coatings, Inc. questioned whether their caulk (sealant), which has a VOC limit of 397 g/l, would meet the sealant standard. The product is used in secondary containment areas, usually in chemical plants and fuel storage areas, and is chemically resistant.

Response: If the caulk is intended for architectural applications, such as secondary containment or storage tanks, the VOC limit is 250 g/l. There are low VOC products available, such as fluorosilicone, for secondary container and fuel storage tank applications.